

**METHOD OF REPRODUCING A STILL PICTURE FROM A RECORDING
MEDIUM, METHOD OF DECODING THE STILL PICTURE AND THE
RECORDING MEDIUM**

RELATED APPLICATION DATA

[0001] This is a continuation of application No. 09/698,263 filed October 30, 2000; the contents of which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to method of reproducing data; and more particularly, a still picture.

2. Description of the Related Art

[0003] A high-density digital versatile disk (HD-DVD), whose recording standard is under discussion among related companies, is a high-capacity storage device for moving pictures of large size, so that it will be widely used soon. In the meantime, a disk reproducing device (referred as 'HDVD player' hereinafter) which is being developed to reproduce a high-density digital

versatile disk is expected to be connected with a digital television through IEEE 1394 standard when it playbacks an inserted disk.

[0004] When a HDVD player is connected with a digital television to playback a HD-DVD, it should have specific video pictures to be displayed as still images on a screen of a digital television. Examples of the specific video pictures are a background image of menu bars for selection of various functions provided from a HD-DVD, and a menu screen for editing a content scenario of a moving picture program recorded in a HD-DVD.

[0005] To embody still picture of data stream recorded in a DVD-ROM which is being popularized more and more, a still mark is written behind a data stream section corresponding to a still picture, and a DVD-ROM player, which can reproduce a DVD-ROM disk, repeats to output the last-decoded stream section if a still mark is detected while reproducing recorded programs.

[0006] This method is possible since a DVD-ROM player has been developed in expectation that it is to be connected with an analog television not equipped with a MPEG decoder so that it has a MPEG decoder as an internal component, therefore, a DVD-ROM player can detect still marks contained in data stream while decoding data stream recorded in a DVD-ROM disk.

[0007] However, a HDVD-player may not have a MPEG decoder as an internal component since it is under development on assumption that it may be connected a digital television equipped with a MPEG decoder through a digital

interface such as IEEE 1394 as aforementioned.

[0008] Therefore, even though still marks are inserted in every data stream section corresponding to still picture in a HD-DVD as in a DVD-ROM, a HDVD player can not conduct still operation if it has not a decoder, that is, it can not detect the still mark.

[0009] In addition, a digital television developed at present can not support still function for data stream when it receives data stream from a HDVD player connected through a digital interface, so that it is urgently required to develop a method of presenting a specific data stream section from a disk device such as a HDVD player in a still picture at a digital television.

SUMMARY OF THE INVENTION

[0010] In the method of reproducing a still picture from a recording medium according to one embodiment of the present invention, an I-picture and a number of P-pictures are output as a still picture based on video data reproduced from the recording medium. For example, the P-pictures output represent a same picture as the I-picture being output.

[0011] In another embodiment of the present invention, the I-picture and the number of P-pictures representing a still picture are received and decoded for display.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The accompanying drawings, which are included to provide a further understanding of the invention, illustrate the example embodiments of the invention, and together with the description, serve to explain the principles of the present invention.

[0013] In the drawings:

[0014] FIG. 1 shows a digital television and a HDVD player to which a method for supporting a still picture of data stream recorded in a disk according to the present invention is applied;

[0015] FIG. 2 shows a format example of a recorded stream to embody a still picture supporting method according to the present invention;

[0016] FIG. 3A shows a format example of a recorded stream to embody another still picture supporting method according to the present invention;

[0017] FIG. 3B shows an information example written in a cell associated with a stream object containing a still picture data; and

[0018] FIG. 4 shows a transmission example of a recorded stream corresponding to a still picture according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0019] In order that the invention may be fully understood, exemplary embodiments thereof will now be described with reference to the accompanying drawings.

[0020] FIG. 1 shows a digital television 200 and a HDVD player 100 to which a method for supporting a still picture of data stream recorded in a disk according to the present invention is applied. The digital television 200 and the HDVD player 100 are connected each other through a IEEE 1394 digital interface.

[0021] The data written in a HD-DVD which is to be playbaced in the HDVD player 100 is grouped into high-density stream objects (called 'HOBs' hereinafter). A HOB may correspond to a single program or a digital stream recorded from recording start to stop, and it is to be associated with each cell which is used for determining the playback sequence of moving picture contents recorded in a HD-DVD.

[0022] FIG. 2 shows a format example of a recorded stream to embody a still picture supporting method according to the present invention.

[0023] As shown in FIG. 2, the data stream belonging to a certain HOB contains a still packet as still information. The function of a still packet is to command the digital television 200 to repeat to decode a stream constituting a single picture following the still packet instead of advancing the reproduction,

and a still packet contains still duration information indicating how long the requested still operation lasts. The still duration is classified into two types of the definite and the indefinite. The definite type may have time value ranging from 1 to 254 seconds, and the indefinite type is used in a condition that a key command from a user is necessary.

[0024] When the data stream recorded as in FIG. 2 is reproduced in the HDVD player 100 and is transmitted to the digital television 200 through the isochronous channel of the IEEE 1394 digital bus, the still packet is also transmitted to the digital television 200 without being decoded. When the digital television 200 receives the still packet while decoding the received data stream into real video and/or audio signal, it extracts still duration information from the received still packet. After that, the digital television 100 decodes data stream section, which is following the still packet, corresponding to a single picture and then repeats outputting the just-decoded video picture during the time indicated by the extracted still duration information.

[0025] If the time indicated by the still duration information expires, the digital television 200 stops repeating of decoding of same picture, and then resumes to decode next pictures, which may have been already stored in an internal buffering memory, succeeding the still picture.

[0026] Through the above-explained operations, a picture can be held as a still picture in a digital television for a certain time.

[0027] In the above-explained embodiment of the still picture

supporting method, an additional command for holding a picture and resuming successive decoding needs not be sent from the HDVD player 100 to the digital television 200.

[0028] Instead of positioning a still packet before a still picture, a still packet may be preceded by a still picture. In this case, the HDVD player 100 may turn its mode into a pause without advancing next pictures as soon as it identifies a packet as a still one based on a packet header. And the digital television 200 repeats decoding a partial data stream, which is received prior to a still packet, constituting a single picture when the received packet is determined as a still one. This interoperation between the HDVD player 100 and the digital television 200 can also achieve still function.

[0029] The still packet may not contain information on still duration. Instead, the HDVD player 100 resumes data reproduction from recorded data following the still packet and transmits the reproduced data stream to the digital television 100 if a user requests release of still status. According to the resumption of data reproduction, the digital television 200 receives data packets next to the still packet, then it acknowledges the reception of data packet as release of still picture, and decodes the received data packets as soon as it stops repetition of decoding of one picture.

[0030] FIG. 3A shows another format example of a recorded stream to embody a still picture supporting method according to the present invention.

[0031] As explained above referring to FIG. 2, the data written in a

HD-DVD which is to be played back in the HDVD player 100 is grouped into HOBs. A HOB is also corresponding to a single program or a digital stream recorded from recording start to stop, and it is related with each cell which is used for determining the playback sequence of moving picture contents recorded in a HD-DVD.

[0032] And, a HOB is composed of high-density stream object units (referred 'HOBUs' hereinafter), and a data stream constituting a HOB is recorded across a lot of data packs as shown in FIG. 3A. A data pack is a data accessing unit whose size is physically readable and/or writable at a time, that is, it is corresponding to a sector of a DVD-ROM. Each data pack consists of a pack header and several transport packets written in it.

[0033] The pack header comprises fields of 'STILL Indicator', 'SYS_PCR_base', 'SYS_PCR_ext', and 'Reserved'. A transport packet may contain a program clock reference (PCR) which consists of a 9-bit extension value and a 33-bit base value according to the MPEG standard. The extension value is a modulo-300 counter that is incremented at a rate of 27 MHz, whereas the base value is incremented at a rate of 90 KHz. If a transport packet contains a PCR, the PCR is copied to the fields of 33-bit 'SYS_PCR_base' and 9-bit 'SYS_PCR_ext', respectively. The field of 'STILL Indicator' is a 1-bit flag and is used to indicate whether or not a data pack has data stream to be transmitted repeatedly. That is, if the flag is 1, it means that the pack and following packs including data of Infra-coded picture (I-picture) and predictive pictures (P-pictures) should be

transmitted repeatedly.

[0034] In addition, a cell associated with a HOB containing one or more still pictures consists of general information and still picture entry point information as shown in FIG. 3B. The general information has various information on reproduction sequence of still pictures, whether there is still picture or not, and the number of still pictures. And, the still picture entry point information has information indicating all of HOBUs in which data stream sections corresponding to still pictures are written. The information on whether there is still picture or not and the number of still pictures is written in 1-byte field of 'Still_YES'.

[0035] Therefore, when reproducing a HD-DVD, the HDVD player 100 examines information written in a cell to know whether there is still picture and where still picture is written among a lot of HOBUs, and searches for a corresponding HOB based on the known information. Then, it examines the successive pack headers belonging to the HOB to know whether the value of 'STILL Indicator' field is 1 or not.

[0036] If the value is 1, the HDVD player 100 reads data stream section containing I-picture data and next P-picture data only and then repeats to transmit the read data stream section to the digital television 200 as shown in FIG. 4. The I-picture data is composed of a sequence header, a header of group of pictures (GOP), and real video data, and the P-picture data is composed of a header and predictive real data.

[0037] The transmission ratio of I-picture to P-picture is 1:15. That is, a I-picture is transmitted once every 15 transmission of P-picture. When transmitting the I-picture repeatedly, the HDVD player 100 generates a PCR whose value is transporting time of each transport packet constituting the I-picture, and inserts it into every packets or every a few packets. When transmitting P-pictures repeatedly, the HDVD player 100 transmits P-picture header only without transmitting predictive real data.

[0038] The information of transmitting repetition duration, i.e., still duration may be written in a cell or a pack header. If this information has been written, the HDVD player 100 resumes next reproduction after stopping the transmitting repetition when the still duration expires, if has not, it resumes next reproduction when a user requests to do that.

[0039] In this embodiment of still picture supporting method, the digital television 200 needs not conduct an additional operation for still mode, instead, it just conducts a normal operation to decode the received data stream section provided repeatedly from the HDVD player 100.

[0040] The still picture supporting method according to the present invention makes it possible to present a background image of menu bars for selection of various functions provided from a HD-DVD and a menu screen for editing a content scenario of a moving picture program recorded in a HD-DVD as a still picture on a digital television on condition that a HDVD player is delivering real data in the format of data stream to a digital television connected through a

digital interface such as IEEE 1394.

[0041] The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.